NEGATIVELY TAXED FARM EXPANSION INVESTMENTS IN ILLINOIS: A REVIEW OF THE EVIDENCE

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Introduction

A considerable amount of economic research, both conceptual and empirical, has been done on the impact of the tax structure upon investment decisions (Jorgenson and Stephenson, Bailey). It is a well known result of classical static economics that a tax on pure profits does not affect the optimum levels of output and inputs of a profit maximizing firm. In practice, however, profit taxes are not levied on pure profits. Taxable profits differ from pure profits in at least three ways; first, the return to equity capital is treated as taxable; second, owing to various investment allowances, true depreciation may differ from depreciation for tax purposes; and, third, capital gains are usually taxed imperfectly.

The affects of tax structure on resource allocation within production agriculture have long been debated. Federal tax provisions are often suggested to be non-neutral with respect to the size of farm (Raup; Gardner; Davenport, et al.). Such non neutrality may provide either incentives or disincentives for farm size expansion. Further, tax provisions often favor one enterprise size or type more than another, thus influencing capital investment patterns within the agricultural sector.

There are several features of the federal tax system which often are suggested to have farm size related effects. Raup has suggested that such tax policies as investment tax credits, accelerated depreciation, use of cash basis accounting, and the deductibility of interest as a business expense stimulate the demand for capital items. Under certain conditions with respect to the supply of capital such provisions may substantially accelerate the substitution of capital for labor. Further, these provisions are size related in that the resulting tax savings will increase with the size of the taxpayer's income because of the progressive tax rate structure.

Previous Research

Over the last decade there has been substantial empirical work in the area of tax effects on agricultural production. Batte incorporated an estimate of federal income tax liability as an implicit cost of production for cash grain producers in Illinois. His findings suggest that the effective tax rate is progressive, although this progressivity was small. Baker utilized data from tax returns of Indiana farmers to study the relationship between average effective tax rate and the size of farm. His results indicate that the use of various tax credits offset largely the progressive nature of the federal tax rate structure. These studies suggest that federal income taxes are not a major deterrent to farm size expansion for this type of producer. Edwards and Boehlje considered the impacts of federal income tax legislation upon the size of the least cost machinery set. They found that the inclusion of income tax effects reduced the variability of costs from year to year, thus reducing income tax liability over time and encouraging firm growth.

Musser suggests contradictory results in a study evaluating economies of size in midwest crop production. His results suggest that the inclusion of taxes as an implicit cost of production reduced the size of farm at which the minimum average costs occurred. Musser's conclusions may be in error, however, because his results are based on the assumption that marginal tax rates increase with farm size; a conclusion largely in contradiction to the Batte and Baker studies.

In addition to questions concerning the effective progressivity of the tax structure, the special tax treatment of capital gains may result in an altered resource allocation within agricultural production. Duffy and Bitney studied the effects of the capital gains tax provisions on hog farrowing

enterprises. These provisions encouraged hog producers to utilize all gilts for one farrowing in order to qualify these animals for capital gains tax treatment. Reid, Musser, and Martin studied optimal enterprise organization for crop-hog farms in Georgia and suggested that the inclusion of income taxes resulted in hog enterprises becoming a more dominant part of the farm business, primarily because of the capital gains provision of the hog enterprise. Musser, Martin, and Saunders found the capital gains provision to be an important incentive for crop farms to diversify into livestock production.

Davenport, et al., observe that because many farm investments receive tax preference under income and estate tax rules, such investments will produce lower tax liabilities than a similar investment yielding the same rate of return but not having tax preferences. The extreme of such a tax shelter is an investment for which the present value of the tax deductions exceeds the investment cost. This has been referred to as a "negative tax" (Bailey; Hanson; Davenport, et al.). The acquisition of an asset which generates tax savings rather than tax obligations may substantially alter the cost/size relationship of farms, and may stimulate increased farm output. Also stimulated will be the demand for the capital assets which contribute to the negative tax. In the long run it is reasonable to believe that the price of the negative tax creating asset will be bid upward sufficiently to equate the after-tax rate of return of this asset with those of similar assets which are not negatively taxed. Certainly, such a result would have structural impacts on the agricultural sector.

A simulation analysis conducted by Boehlje evaluated the effect on land prices of the differential tax treatment for capital gains. Various other parameters such as leverage and holding period also were considered. Maximum

land bid prices were found to increase substantially as land appreciation (as a percent of total land return) increased. That is, as more of the earnings attributable to land received capital gains treatment, bid price for land increased.

Hanson explored the negative tax issue by analysis of the tax liabilities of Minnesota farmers with combined land and machinery investments during the 1972-78 period. Although his results were not conclusive, the expansion investments resulted in lower tax liabilities and higher tax shielded income for 7 of the 10 cases studied.

Objectives

The purpose of this paper is to consider the tax consequences of an expansion of the farm unit, including land and machinery purchases. The TAXMODL simulator developed at Minnesota by Hanson will be applied to farm records data from another source to determine if the results suggested by Hanson are supported. The organization of the paper is as follows. The next section will present the theoretical attributes and data requirements of the Hanson model. Discussion of the attributes of the Illinois data set will then occur, followed by the results of the application of the Hanson model to these data. Finally, the summary and conclusions will be presented.

The Minnesota "Negative Tax" Study

The existence of negative taxation and its magnitude for a sample of farms was studied by Hanson. The theoretical model used by Hanson to develop his specific hypotheses departs from the traditional economic model of the maximization of after tax profits where it is implicitly assumed that economic expense equals tax deductions. In the traditional model a profits tax is

neutral in that it does not alter the implicit optimality rules for resource allocation. Instead, Hanson argues, as have many others (e.g. Bailey), that "there is no reason to expect that...the economic value of depreciation automatically is equal to the depreciation tax deduction permitted by the tax code."

The conceptual model follows along the line of the "tax expenditure profit maximization model." This model is stated as:

(1) $ATP = (1-t)(SR) - GW - VE - AGI(L,M) - CGT + CVWTD + CVVETD + CVCATD$

where ATP is the after tax profit, t is the effective tax rate, SR is sales revenue, GW is gross wages, VE is variable expense, AGI(L,M) is annual gross investment in land (L) and machinery (M), CG is capital gains tax, CVWTD is cash value of wage tax deductions, CVVETD is cash value of variable expense tax deductions, and CVCATD is cash value of capital asset tax deductions. All input costs are appropriately adjusted to reflect the prevailing tax structure. This basic model is extended to a multi-period optimization model by expressing ATP as the present value of after tax profits. The problem facing the agricultural farm firm is to choose variable and capital inputs so as to maximize the present value of after tax profits subject to the implicit rental prices and tax rates facing the firm.

Hanson derives the solution to this optimization problem by taking the derivatives of APT with respect to the choice variables, Labor, Variable inputs, Land, and Machinery and setting these equal to zero. The implied economic conditions generated by the Hanson model are:

(2) $dV/dN = MPP(N) = ws(1-um)/p,$

(3) $dV/dE = MPP(E) = c(1-um)/p,$

(4) $dV/dL = MPP(L) = [h/p(1-u)]\ [r(1-ud) - g(1-ul)]$,

(5) $dV/dM = MPP(M) = [q/p(1-u)]\ [r(1-k-ud) - j(1-k-uv) - a(1-k-u)]$

where w is the wage rate, s is the employer paid social security tax rate, u is the effective tax rate, m is the percent share of wage deduction resulting from cash basis tax accounting, c is the price per unit of variable expense, h is the per acre price of farm land, r is the effective interest rate, d is the debt/equity ratio, g is the appreciation rate on land per acre, l is the ratio of taxable to nominal capital gains on total capital assets, q is the composite price for buildings and machinery, k is the rate of investment tax credit, j is the constant rate of depreciation, v is the ratio of depreciation tax deduction to economic depreciation, a is the appreciation rate on building and machine assets.

These first-order conditions indicate that optimal input use occurs where the marginal product of the particular input is equated to the "tax adjusted" real rental input cost, not the before tax input cost. The first relationship indicates that labor is used up to the point where the marginal physical product is equal to the tax adjusted real wage rate. Likewise, relationships (3) - (5) require that all inputs be used in the same manner.

These optimal conditions differ from the non-tax model in the definition of real input costs. For example, if the tax expenditure parameters (s), (v), and (l) were all equal to unity, and the debt ratio (d) was also equal to unity, and the rate of investment tax credit (k) as well as the percent share of the wage deduction resulting from cash basis accounting (m) were zero, these conditions would reduce to those of the traditional profit maximization model with tax neutrality. With relevant values for these parameters the real

rental value of the respective inputs declines indicating that the firm should increase its use of these productive inputs.

Furthermore, the optimal conditions given in (2) - (5) imply that the respective marginal products of each of the inputs depends upon the levels of the other inputs in the production process. This is important in that it suggests that any overcapitalization in machinery, which might occur as a result of more liberal tax incentives to spur the purchase of equipment, will necessitate an increase in the other inputs in order to maintain maximum after tax profits. This raises the distinct possibility that the long term impact of liberal tax expenditures may result in a spiral of machinery/land expansion and rising input prices. It should be pointed out, however, that the model developed by Hanson is purely static in nature and does not directly apply to this type of dynamic rationalization. The dynamic elements of the problem can only be inferred from the consideration of multiple static equilibrium points.

It is on the basis of this conceptual model that Hanson explores the existence and extent of tax expenditures occurring in a sample of Minnesota farms. The characteristics of the non neutral tax model also lead to the consideration of negative taxation of specific investment assets. In particular, Hanson argues that with the present tax structure in U.S. agriculture the tax expenditures associated with machinery investment can result in deductions that are greater than the cost of the investment when measured in present value terms. These investments, when accompanied by nontaxable income in the form of unrealized capital gains are negatively taxed. As was argued by Bailey, the existence of negatively taxed investments can have substantial resource misallocation effects. Hanson empirically defines negative taxation

as occurring when the investment in an asset actually lowers the farmers tax liability even though the investment is generating income.

Defining a negatively taxed investment instrument as having three principal attributes (i) the present value of deductions exceed cost, (ii) income from the investment is untaxed, and (iii) other income is available to receive the tax shielding benefit of the tax deductions generated by the investment, Hanson develops a tax simulator--TAXMODL--which is used to calculate total tax liabilities for a sample of Minnesota farms. Negative taxation is identified by first calculating the total tax liability with the land/machinery expansion compliment and then using a linear homogenous acres rule, subtracting revenue and expense attributable to the land expansion and recalculating the farm firm's total tax liability. If the tax liability increases in the second case then the land expansion assets qualify as negatively taxed investments whose deductions have offset other income and lowered the farm firm's tax liability.

From a sample of 76 farms over the period 1972-78, Hanson identifies 10 farms hich conform to a specific set of criteria proposed by Hanson as necessary to identify those farms with land/machinery expansions. Applying the TAXMODL, Hanson concludes that on the average for his sample, land and machinery expansion account for a reduction in taxable income of $3,525 and $533 in reduced tax liabilities. In reaching this conclusion, Hanson allocated 68% of the allocable interest to the expansion assets. Had he allocated the entire amount of allocable interest to the expansion expense, the difference in pre and post expansion tax would have been $1,546 instead of $533. Hanson also concludes that an average of $25,790 of expansion income in the form of land appreciation was shielded from taxes during the sample time period.

Other significant results of the Hanson study relate to the magnitude of off-farm income and farm economic size. In the sample identified for the tax calculation the off-farm income was 40% larger on average than for the entire sample of 76 farms. This may suggest that negative taxation is available only to those in the agricultural production sector with substantial outside income. As for a significant correlation of negative taxation and farm size, none was found in the sample studied.

Limitations of the Minnesota Study

The results of the Hanson effort are not at all conclusive. It is likely that the results are sensitive to the allocation rules used to expense expansion versus non-expansion items. The use of a linear homogenous acres rule to arrive at the magnitude of income and expense attributable to the expansion investment may be qustionable. Implicit in this rule is the assumption that for all farms studied, the productivity of the additional acres is equal to the average productivity of the base acreage. There is no allowance for the possibility that some farms may be more productive than others, and for the same aount of deductible investment allowances, some farms may have substantially different amounts of marginal gross income relative to their pre-expansion base on the additional acres. Thus, this homogenous acres allocation rule may bias negative taxation in favor of less productive operations. Also, given the fact that the income from the expansion is taken in the form of unrealized capital gains on land appreciation, Hanson does not address the question of the long term affects when land prices may rise and fall, nor does he consider the long term affect of the land/machinery demand on the rate of growth in machinery prices.

Although the results of the Hanson study are not as strong as one would like, taking the collective weight of the studies addressed above and the fact that in the Hanson study there was some evidence of the negative taxation phenomenon, it would be useful to explore this concept further. As Hanson points out, because of the sensitivity of the results to the rules used to allocate expenses across different enterprises, the ideal candidates for future tests would be grain farms with no or little livestock operations. Also, data from the late 1970's would be desirable. The data from the Illinos farm record system is very suitable to the type of analysis and may help provide additional insight into this area.

Data Source

The source of data for these analyses is a sample of individual cash grain producers drawn from the Illinois Farm Business Farm Management Association (FBFM). The membership of the FBFM does not constitute a random sample of the larger population of Illinois farmers. The difference in these groups may not be great, however. Mueller compared a sample of FBFM cooperators to a random sample of Illinois producers and concluded that the differences were "essentially differences in the quantity of basic resources, particularly land and capital utilized by the farm operators . . . and, given equal basic resources, managerial ability is not greatly different on record keeping and survey farms" (p. 292).

There are aspects of the FBFM sample which provide improved data accuracy over that which could be expected from a random sample of producers. The FBFM records are standardized in accounting format. The accounting procedures used are well documented, both to the farmer-members and to the researcher. As a

result, the researcher has more confidence as to the content of each cost and receipt account. Also, field agents are available to assist members. This further increases the accuracy and standardization of the accounting records. Finally, the FBFM records provide observations for a relatively large number of producers for a multi-year period.

The sample of FBFM producers available for this analysis is made up predominantly of cash grain producers. Only farms classified by FBFM field agents as "usable" were included. This excluded farms which were, for one reason or another, "non-typical" of Illinois agriculture or which were suspected of containing accounting errors. Also, the sample was structured to include only farmers for whom corn, soybeans and wheat accounted for 95 percent or more of tillable acreage. Further, farm records were excluded from the sample if income derived from other farm sources was more than 5 percent of total receipts. This excluded farms with major livestock enterprises in addition to the cash grain enterprises, or farms with major income arising from such farm related activities as the provision of custom services to others. Finally, membership of the sample was restricted to those producers who were continuously enrolled in the FBFM for the five years, 1975-79. A result of this structuring is a sample which is very homogeneous: One which portrays the essential characteristics which Hanson felt important for analysis of negatively taxed investments.

A potential difficulty with the sample is that its membership is mixed with both owner-operators and part-owners. This is not considered to be a major limitation, however, because receipt and expense items were recorded separately for the operator and landlord entities. It did present a problem

in the sense that part-owner operations have the opportunity to change land base by means other than land purchase.

Another deficiency to be recognized is that the FBFM records do not contain information about non-farm income. For this reason it is not possible to identify farmers who may have substantial non-farm income to be shielded by tax preference items. This may be an important deficiency because the farms which were found by Hanson to be negatively taxed had substantially larger non-farm incomes that the remainder of the sample.

The sample meeting the above restrictions contained 167 producers. Average farm size was 522 tillable acres with a standard deviation of 229 acres. Farm sizes ranged from 140 to 1632 tillable acres.

Because it is the purpose of this study to calculate the tax liabilities of farmers, it is necessary that substantial information concerning income, expenses, and depreciable investment inventories be available. Although the FBFM records data do not specifically include measures of the taxes paid, the majority of the information required for these calculations are available.

Application of TAXMODL to the FBFM Data

The analysis of negatively taxed investments as conducted by Hanson required the identification of a sample of producers who had expanded the land/machinery complement. Starting with an initial sample size of 76 Minnesota producers for the period 1972-78, Hanson applied the following criteria for case selection:

1. Tillable acres purchased must be greater than or equal to 40.
2. Purchase of expansion land must increase total acres farmed.
3. Cases with large purchases of feeder cattle were excluded.
4. Cases with frequent changes in acreage were excluded.

The case selection process is somewhat easier for the Illinois sample because production is essentially limited to the corn, soybean and wheat enterprises. Hence, restriction three was met when the sample was selected. Of the 167 producers in the sample, 29 purchased land during the 1975-79 period. Of these, 11 were considered nonusable because of frequent changes in land base resulting from leasing transactions. Additionally, 2 producers both purchased and sold land during this period. The result of applying selection restrictions three and four was a sample of 16 producers.

Application of Hanson's restrictions one and two proved to be too restrictive for the sample of FBFM producers. Two of the land purchases were less than 40 acres. More problematic, however, was the restriction concerning farmers who had farmed the land previous to its purchase. This accounted for 11 producers. Thus, by applying all restrictions, the number of observations was reduced to three.

In order to retain a reasonable number of observations, we choose to omit restriction two and to modify restriction one to include 16 farms with purchase of more than 27 acres. Clearly, of these modifications the former has the greatest consequence for the conclusions of this study. Hanson has argued that the machinery complement does not have to be expanded in conjunction with land purchase if the land is already under operation by the producer and, hence, the land/machinery expansion unit is not properly recognized. However, if the lease was entered into just shortly prior to the purchase, part of the building and machinery deductions would still be available. Additionally, with the purchase of the land, the operator is able to allocate the basis of the property between real estate and depreciable assets, and thus capture some depreciation resulting from the purchase.

Modifications to TAXMODL

Before the TAXMODL tax accounting model was applied to the FBFM data, several modifications were made. In the Hanson analyses, the identification of negatively taxed investments hinged on the ability to accurately allocate costs and receipts between the pre- and post-expansion land base. To accomplish this, the "homogeneous acre rule" was applied. As stated earlier, this is simply an allocation of expense and receipt items based on the proportion of expansion acres to total acres after expansion. Because the FBFM sample was made up entirely of part owners, the TAXMODL cost allocation rules were modified such that the operator's real estate taxes were allocated only among the acres owned by the operator. Further, the cash interest allocation rule was modified to assume a maximum of 80 percent of the value of the expansion was debt financed. A 100 percent leverage assumption was previously used in TAXMODL. Sensitivity analyses were employed to test for differences in the 80 and 100 percent debt finance expansion rules. The differences were not important for the majority of the sample.

The remaining assumptions of TAXMODL are left intact. Some of the more important of these are:

1. Federal and state income tax provisions were incorporated into the model, explicitly representing the laws which were in effect during the time period of the data under study.
2. Nonfarm income was not available in the producers' records and was assumed to be zero.
3. A family size of four was assumed for all producers.
4. The standard deduction was used in state and federal income tax calculations.

Application of TAXMODL to the 16 FBFM producers indicates that expansion produced a negative tax change for individuals and a positive tax change for the remaining 9 producers. (Results by year for individual producers are presented in Tables 1 and 2.) However, of greater importance than the number in each of these groups is the magnitude of the changed tax liabilities. The tax changes for those individuals with negative adjustments in tax resulting from expansion were small relative to the group who realized increased taxes. Considering only the year in which the farm expansion occurred, tax changes (1977 dollars) ranged from -$2,285 to $9,451 (figure 1). Only 3 producers had an initial year negative tax change greater than $1,000. However, 8 producers realized a tax increase larger than $1,000. The means and standard deviations for the tax change measures by groups realizing positive and negative tax changes are presented in Table 3.

The group with negative tax adjustment from expansion appears to differ from the tax increase group in several respects. The former group farmed more acres, owned an average of 40 acres more land, and had a substantially larger pre-expansion gross income than did the latter group (Table 3). The pre-expansion gross income earned per acre also is larger for the negative tax group. This provides some evidence that this group does not realize negative tax changes simply because of poor physical performance.

It is interesting to note that the relationship between average gross income, average operators taxable income, and allowable deductions appears to be substantially different for the two groups. Those who benefited from expansion by lowering their combined tax liability had gross earnings 58% larger than the positive tax group, but taxable income only 56% of the latter group. This was achieved of course by having substantially larger average

deductions. For example, the cash interest for the negative tax recipients was almost five times the same expense for the positive tax group.

This disparity in income versus deductions for these two distinct groups raises a number of interesting questions. For example, does this indicate that the tax liability reduction incentive fosters the artifical inflation of operating costs, both variable and capital related? If the answer is yes, then what are the implications for other income support programs which are based on the cost of production?

Statistical Analysis and Interpretation

For the majority of producers in this sample, expansion of the land base results in increased tax liability. To help identify some of the factors associated (at least for this sample) with the magnitude of the tax changes resulting from expansion the following multiple linear regression models were estimated:

Model I

$$\begin{aligned} TAXDIF = {} & -1488.32 + 0.08\ RTI + 41.84\ PEREXP \\ & (-.76) \quad (2.58) \quad (3.17) \\ & -1.32\ MCA - 61.15\ PEL \\ & (-0.18) \quad (-2.84) \end{aligned}$$

$R = 0.84 \quad F = 14.37 \quad DF = 11$

Model II

$$\begin{aligned} TAXDIF = {} & -1798.5 + 0.08\ RTI + 43.66\ PEREXP \\ & (-1.78) \quad (2.74) \quad (5.12) \\ & -64.03\ PEL \\ & (-4.44) \end{aligned}$$

$R = 0.84 \quad F = 20.83 \quad DF = 12$

Numbers in parantheses below the estimated coefficients are the t values.

TAXDIF is the tax change (sum of federal and state income taxes and the self employment tax) occurring in the expansion year. Because we are comparing purchases of land occurring in different years, all variables are expressed in constant 1977 dollars. RTI is taxable income for the expansion year. PEREXP is land expansion as a percentage of the pre-expansion owned land base (acres). MCA is the deductible exenses allocated to the expansion on a per acre basis. These expenses include depreciation, interest and investment tax credit. PEL is the pre-expansion leverage as measured by cash interest carried by the farm operation in the year prior to the expansion year, on a per acre basis.

Two models were estimated because by looking at the summary data in Table 3 it was apparent that the realization of tax reduction due to expansion was due to the relative size of real taxable income and allocable expenses. What was not clear was whether or not the expansion per se contributed to the magnitude of the allocable expenses or whether this was a pre-expansion attribute.

In Model I, both the leverage prior to expansion and the costs attributable only to the expansion, on a per acre basis, were included as explanatory variables. The signs of the coefficients were as expected, however, the standard error of the MCA parameter estimate is very large. Thus, it appears that the cost associated with expansion acres, which includes interest, depreciation and first year investment tax credits, is not influential in explaining variations in TAXDIF.

In light of this, Model I was dropped in favor of Model II. This specification suggests that it is the per acre cash interest prior to expansion PEL which is most influential in explaining differences in tax liability changes.

Netting out the effects of RTI and PEREXP, a 10% increase in cash interest per acre results in a 9.1% decline in tax liability with expansion.

This result has rather important implications for the negative tax/resource allocation debate. The evidence presented here suggests that the magnitude of the negative tax incentive is related to the debt service charge per acre on existing land rather than the allocable expenses, including investment credit, per acre of expansion land. This does not suggest, however, any reason related to the tax structure as to why some farms prior to expansion have high debt service charges per acre than others. It may well be that some farm firms, when faced with high gross income years over invest in machinery and other capital equipment and do so out of debt financing rather than equity financing. These farms are then in a position to realize negative tax effects from land expansion. Such an explanation, if correct, would focus our attention on the relationship between the tax structure and machinery expansion as the primary element and land expansion as a secondary effect.

The partial effects of the explanatory variables PEREXP, PEL and RTI are illustrated in figures 2 and 3. Figure 2 (panel a) illustrates graphically the estimated relationship between real tax change and PEREXP. The lower panel of this figure illustrates how PEREXP will shift the relationship between TAXDIF and RTI with PEL held constant. A similar set of relationships is presented in figure 3 for PEL.

Conclusions

A primary purpose of this study was to further test empirically the hypotheses of Hanson and others that farm expansion assets are negatively taxed. This was accomplished by application of the Hanson TAXMODL to a sample of Illinois FBFM cash grain producer records. Of the 16 individuals analyzed,

only 7 portrayed diminished taxes as a result of expansion. Further, the magnitudes of these tax savings were not large. The sample average in the year of expansion in real dollars was $769. The magnitude of tax change was greater for those individuals who realized a positive tax increment from expansion. The sample average increase in real terms was $3596.

Descriptive statistics provided evidence that the groups with positively and negatively tax expansion were substantially different with respect to the degree of leverage employed in the expansion. Multiple linear regression techniques indicated that the positive tax change resulting from expansion was positively related to real taxable income, positively related to the relative size of the expansion unit, and negatively related to the amount of pre-expansion debt service per acre of expansion. Direct costs per acre attributable to the expansion including interest, depreciation and investment credit were not significant in explaining the changes in tax liability.

There are several important limitations to these analyses. Obviously, the sample size is small, thus putting great weight on each producer's record. An additional concern, however, is the violation of Hanson's selection criteria; especially the restriction concerning farmers who purchased land previously farmed under a lease agreement. Indeed, if these farmers adjusted the machinery complement substantially prior to the land purchase, then we do not, as Hanson argues, have a true land expansion, but only a change of ownership of assets. If there is a strong positive relationship between the prior purchase of machinery and equipment and high per acre debt service then the results here may suggest a machinery-land expansion incentive. However, this is only suggestive as there is no way of testing for the prior correlation in this data sample.

Finally, concern must be expressed about the revenue-cost allocation rules. The "homogeneous acres rule" included in TAXMODL may not be sophisticated enough to recognize the true leverage involved in land purchases. Tax liability changes are generated in comparing expansion records with no expansion by adjusting both the farms gross income and expenses to arrive at a non-expansion taxable income. If the rule used to adjust income introduces a bias then the tax calculation will also be biased.

In conclusion the results of our study do not completely support the findings of Hanson. We do find the existence of negative taxation in seven farms out of sixteen studied. However, the amount of tax liability reduction is relatively small while for the other nine farms who also expanded the increase in tax liability was substantially larger. We cannot conclude, however, that the evidence cited here supports the argument that negative taxation is a primary economic inducement to land expansion. There were notable disparities between those farms who experienced tax increases and those who experienced tax reductions. Most notable was the difference in gross income and taxable income for the latter group and the fact that this group had much higher debt service requirements per acre of operated farm land. The sample data were not robust enough to allow us to discern what the economic reasons were for these disparities. In recognition of the limitations of the data base, these results should be interpreted as suggestive as to the direction of future research in this area. Clearly, more work is required. Also, it is clear that data requirements for this type analysis are stringent. We would suggest that a coordinated effort needs to be undertaken to collect, on a diverse geographic basis if possible, producer information concerning land/machinery expansion. Such information will need to focus carefully on the adjustments

of receipts and deductible expenses resulting from expansion, and should pay particular attention to the magnitude and timing of the machinery and equipment purchase decisions relative to land expansion. This would help to reduce the dependency of future analyses on the allocation of revenue-expense components among enterprises and between pre- and post-expansion business organizations.

Table 1. Income,expense and tax measures by year for producers with a tax decrease resulting from expansion.

Measure	Observation 1 with expansion	1 without expanion	2 with expansion	2 without expansion	3 with expansion	3 without expansion	4 with expansion	4 without expansion
1975:								
Gross income	67678	67678	99182	99182	131427	131427	106839	106839
Cash interest	2091	2091	2913	2913	1326	1326	4902	4902
Depreciation	10890	10890	21795	21795	21990	21990	15410	15410
Other deductible exp.	24585	24585	42303	42303	92178	92178	47717	47717
Income tax--federal	6811	6811	5067	5067	0	0	6141	6141
Income tax-state	749	749	822	822	442	442	888	888
Self employment tax	1114	1114	1114	1114	1114	1114	1114	1114
1976:								
Gross income	92433	92433	114840	114840	194083	194083	103671	103671
Cash interest	6297	6297	4066	4066	5940	5940	5093	5093
Depreciation	13213	13213	25717	25717	27906	27906	18270	18270
Other deductible exp.	36797	36797	46304	46304	128322	128322	60707	60707
Income tax--federal	7273	7273	5282	5282	0	0	0	0
Income tax--state	906	906	1037	1037	867	867	358	403
Self employment tax	1209	1209	1209	1209	1209	1209	1209	1209
1977:								
Gross income	76959	76959	103034	96284	186680	186680	147684	147684
Cash interest	5371	5371	5989	0	1052	1052	11256	11256
Depreciation	14376	14376	33057	30891	27734	27734	17710	17710
Other deductible exp.	27777	27777	37677	34807	141526	141526	76288	76288
Income tax--federal	3527	3527	2097	3138	0	0	3335	3607
Income tax--state	720	720	657	714	417	417	972	972
Self employment tax	1304	1304	1304	1304	1304	1304	1304	1304
1978:								
Gross income	89611	89611	116873	109217	203427	190454	117353	117353
Cash interest	5953	5953	15138	8385	9029	1446	9047	9047
Depreciation	15294	15294	23973	22403	32593	30515	19745	19745
Other deductible exp.	32195	32195	51614	47621	144749	135011	55556	55556
Income tax--federal	8332	8332	5850	7001	0	0	3685	3685
Income tax--state	864	864	796	863	428	551	745	745
Self employment tax	1434	1434	1434	1434	1434	1434	1434	1434
1979:								
Gross income	95613	87645	121936	113948	250609	235166	107130	101316
Cash interset	5632	0	16824	8970	18265	9446	10968	3009
Depreciation	17557	16094	29433	27505	38261	35903	23490	22215
Other deductible exp.	36839	33353	50179	46231	176323	164980	76104	71778
Income tax--federal	2381	2610	128	1595	0	0	0	0
Income tax--state	859	844	627	719	399	538	0	42
Self employment tax	1855	1855	1855	1855	1609	1855	0	461

Table 1. Continued

Measure	Observation 5 with expansion	5 without expanion	6 with expansion	6 without expansion	7 with expansion	7 without expansion
1975:						
Gross income	141811	141811	43608	43608	116755	116755
Cash innterest	2639	2639	228	228	9575	9575
Depreciation	20591	20591	9771	9771	21328	21328
Other deductible exp.	54882	54882	17797	17797	46857	46857
Income tax--federal	16687	16968	982	1218	0	0
Income tax--state	1558	1558	368	368	925	925
Self employment tax	1114	1114	1114	1114	1114	1114
1976:						
Gross income	188805	188805	57244	53219	112926	112926
Cash interest	13162	13162	491	0	15214	15214
Depreciation	36710	36710	9453	8788	29231	29231
Other deductible exp.	63927	63927	30583	28155	58615	58615
Income tax--federal	19731	19731	2247	1883	0	0
Income tax--state	1809	1809	408	369	218	218
Self employment tax	1209	1209	1209	1209	1004	1004
1977:						
Gross income	136907	123271	65273	60683	122929	97153
Cash interest	19651	6642	5062	1844	21994	0
Depreciation	32004	28816	12290	11426	32213	25458
Other deductible exp.	74727	66573	30931	28248	65958	51380
Income tax--federal	0	1877	0	184	0	0
Income tax--state	251	466	427	448	159	492
Self employment tax	1110	1304	1304	1304	447	1304
1978:						
Gross income	172468	155290	65973	61334	172711	137272
Cash interest	24971	11524	3705	379	61924	30889
Depreciation	30478	27442	13609	12652	32657	25956
Other deductible exp.	70036	62153	29452	26871	67797	51668
Income tax--federal	11702	12676	2294	2554	0	0
Income tax--state	1108	1146	465	477	189	502
Self employment tax	1434	1434	1434	1434	887	1434
1979:						
Gross income	167866	151146	76108	70757	191419	152135
Cash interest	24861	9221	3791	0	64879	28784
Depreciation	30516	27477	14893	13846	38234	30387
Other deductible exp.	92164	82042	36093	33061	85722	65875
Income tax--federal	1142	3966	2608	2900	0	0
Income tax--state	498	720	533	554	34	507
Self employment tax	1855	1855	1855	1855	433	1855

Table 2. Income, expense and tax measures by year for producers with a tax increase resulting from the expansion

Measure	Observations 1 with exp'sn	1 without exp'sn	2 with exp'sn	2 without exp'sn	3 with exp'sn	3 without exp'sn	4 with exp'sn	4 without exp'sn
1975:								
Gross Income	88607	88607	96296	96296	90291	90291	91801	91801
Cash interest	3356	3356	0	0	0	0	501	501
Depreciation	15510	15510	10985	10985	10974	10974	9957	9957
Other deductible exp	38138	38138	27354	27354	32652	32652	24957	24957
Income tax--federal	1656	1919	18995	18995	12839	12839	17082	17082
Income tax--state	809	809	1440	1440	1127	1127	1334	1334
Self employment tax	1114	1114	1114	1114	1114	1114	1114	1114
1976:								
Gross Income	96674	96674	78643	78643	98382	90480	102903	76403
Cash interest	2556	2556	0	0	0	0	360	0
Depreciation	14049	14049	12166	12166	13824	12714	12530	9303
Other deductible exps.	49258	49258	26514	26514	30137	27396	34240	25108
Income tax--federal	6163	6163	9962	9962	13402	9668	16149	5422
Income tax--state	749	749	973	973	1286	1084	1342	727
Self employment tax	1209	1209	1209	1209	1209	1209	1209	1209
1977:								
Gross income	104958	83936	69505	57663	122921	113048	93452	69386
Cash interest	2740	0	0	0	0	0	14507	967
Depreciation	24065	19245	16302	13525	15718	14456	9676	7184
Other deductible exp.	52959	42020	20573	16734	34117	30875	32195	22787
Income tax--federal	2588	1019	3048	422	24922	19305	7186	4352
Income tax--state	582	406	775	528	1827	1556	858	645
Self employment tax	1304	1304	1304	1304	1304	1304	1304	1304
1978:								
Gross income	119293	95364	70528	58350	96942	86738	93250	75530
Cash interest	2506	0	0	0	0	0	11279	0
Depreciation	28304	22626	19233	15912	18046	16146	10734	8694
Other deductible exp.	74674	59138	35693	29163	35082	30976	40642	31750
Income tax--federal	0	0	1820	876	9164	5845	4940	4379
Income tax--state	296	223	406	291	1036	826	685	630
Self employment tax	1285	1047	1434	1266	1434	1434	1434	1434
1979:								
Gross income	132685	118551	89148	73959	92873	83097	105617	85250
Cash interest	1704	0	0	0	0	0	10914	0
Depreciation	31062	27753	19160	15896	18826	16844	10125	8172
Other deductible exp.	76760	67389	40784	33128	33241	29304	43330	33825
Income tax--federal	853	559	3477	1361	6366	3626	8555	6222
Income tax--state	650	587	655	442	954	760	1013	855
Self employment tax	1855	1855	1855	1756	1855	1855	1855	1855

Table 2. Continued

Measure	Observations 5 with exp'sn	5 without exp'sn	6 with exp'sn	6 without exp'sn	7 with exp'sn	7 without exp'sn	8 with exp'sn	8 without exp'sn
1975:								
Gross income	110702	110702	77058	77058	99731	99731	105346	105346
Cash interest	6128	6128	177	177	1866	1866	2699	2699
Depreciation	9900	9900	15421	15421	10018	10018	9151	9151
Other deductible exp.	60400	60400	30580	30580	46478	46478	51100	51100
Income tax--federal	7836	7836	2795	2795	9411	9411	5580	5580
Income tax--state	913	913	689	689	953	953	1044	1044
Self employment tax	1114	1114	1114	1114	1114	1114	1114	1114
1976:								
Gross income	152919	119918	79690	79690	99633	99633	109395	109395
Cash interest	19176	482	792	792	1839	1839	2664	2664
Depreciation	10486	8223	12606	12606	9232	9232	12574	12574
Other deductible exp.	65210	50406	34752	34752	41311	41311	52612	52612
Income tax--federal	13367	9730	5434	5434	13309	13309	10788	10788
Income tax--state	1514	1255	699	699	1132	1132	981	981
Self employment tax	1209	1209	1209	1209	1209	1209	1209	1209
1977:								
Gross income	152524	119608	92280	83624	90456	90456	97811	97811
Cash interest	30256	11769	673	0	1751	1751	0	0
Depreciation	17218	13502	13971	12661	9312	9312	14040	14040
Other deductible exp.	54214	41104	35051	31535	35661	35661	44067	44067
Income tax--federal	18497	13917	9789	7017	10326	10326	8946	8946
Income tax--state	1384	1157	974	802	1018	1018	936	936
Self employment tax	1304	1304	1304	1304	1304	1304	1304	1304
1978:								
Gross income	144068	112776	105559	94446	85460	75964	98029	98029
Cash interest	26068	6958	6398	730	7769	173	9	9
Depreciation	10917	8546	18758	16783	10308	9163	12603	12603
Other deductible exp.	56277	42597	34619	30671	38225	33720	46690	46690
Income tax--federal	14673	11325	9049	7387	5049	5118	9260	9260
Income tax--state	1343	1143	1050	940	648	651	904	904
Self employment tax	1434	1434	1434	1434	1434	1434	1434	1434
1979:								
Gross income	145093	106850	131343	120412	99657	88584	118603	78899
Cash interest	24896	2670	5619	0	7080	0	38	0
Depreciation	22056	16243	19054	17468	8651	7690	12005	7986
Other deductible exp.	59191	42375	57787	52391	49561	43737	67991	44898
Income tax--federal	10298	8052	7453	6754	6297	5831	7441	1273
Income tax--state	1031	896	1123	1060	769	735	886	355
Self employment tax	1855	1855	1855	1855	1855	1855	1855	1473

Table 2. Continued

Measure	Observation 9	
	with exp'sn	without exp'sn
1975:		
Gross income	106415	106415
Cash interest	28	28
Depreciation	14918	14918
Other deductible exp.	33894	33894
Income tax--federal	16811	16811
Income tax--state	1364	1364
Self employment tax	1114	1114
1976:		
Gross income	97604	97604
Cash interest	0	0
Depreciation	11306	11306
Other deductible exp.	30461	30461
Income tax--federal	16862	16862
Income tax--state	1306	1306
Self employment tax	1209	1209
1977:		
Gross income	93913	93913
Cash interest	0	0
Depreciation	16421	16421
Other deductible exp.	31585	31585
Income tax--federal	9898	9898
Income tax--state	1060	1060
Self employment tax	1304	1304
1978:		
Gross income	101147	101147
Cash interest	0	0
Depreciation	11827	11827
Other Deductible exp.	40289	40289
Income tax--federal	12710	12710
Income tax--state	1150	1150
Self employment tax	1434	1434
1979:		
Gross income	98351	87401
Cash interest	208	0
Depreciation	14270	12681
Other deductible exp.	46984	41676
Income tax--federal	5683	3283
Income tax--state	832	643
Self employment tax	1855	1855

Table 3. Descriptive statistics for producers grouped by negative and positive real tax change in the year of purchase.[a/]

Measure	Producers with a tax decrease resulting from expansion		Producers with a tax increase resulting from expansion	
	Mean	Std. dev.	Mean	Std. dev.
Owned Acres (Year Previous to expansion)	200	134	160	80
Total Farm Acres (Year Previous to expansion)	696	243	532	151
Size of expansion (Acres)	73	56	94	58
Operator's Gross Income (Year previous to expansion)	$118,169	$38,748	$74,739	$19,517
Operator's Taxable Income (Year of expansion)	17,873	11,331	31,850	11,713
Cash interest (Year of expansion)	11,238	6,771	2,258	5,217
Depreciation (Year of expansion)	25,049	9,554	12,885	4,920
Other deductible expenses (Year of expansion)	65,260	37,828	38,101	14,552
Average Tax Change (Year of expansion)				
Federal Income Tax	$ -455	$ 731	$ 3,319	$ 2,512
State Income Tax	-107	126	240	153
Self Employment Tax	-207	325	37	112
Average Total Tax Change	-769		3,596	
Number of Producers in Class	7		9	

a/ 1977 dollars

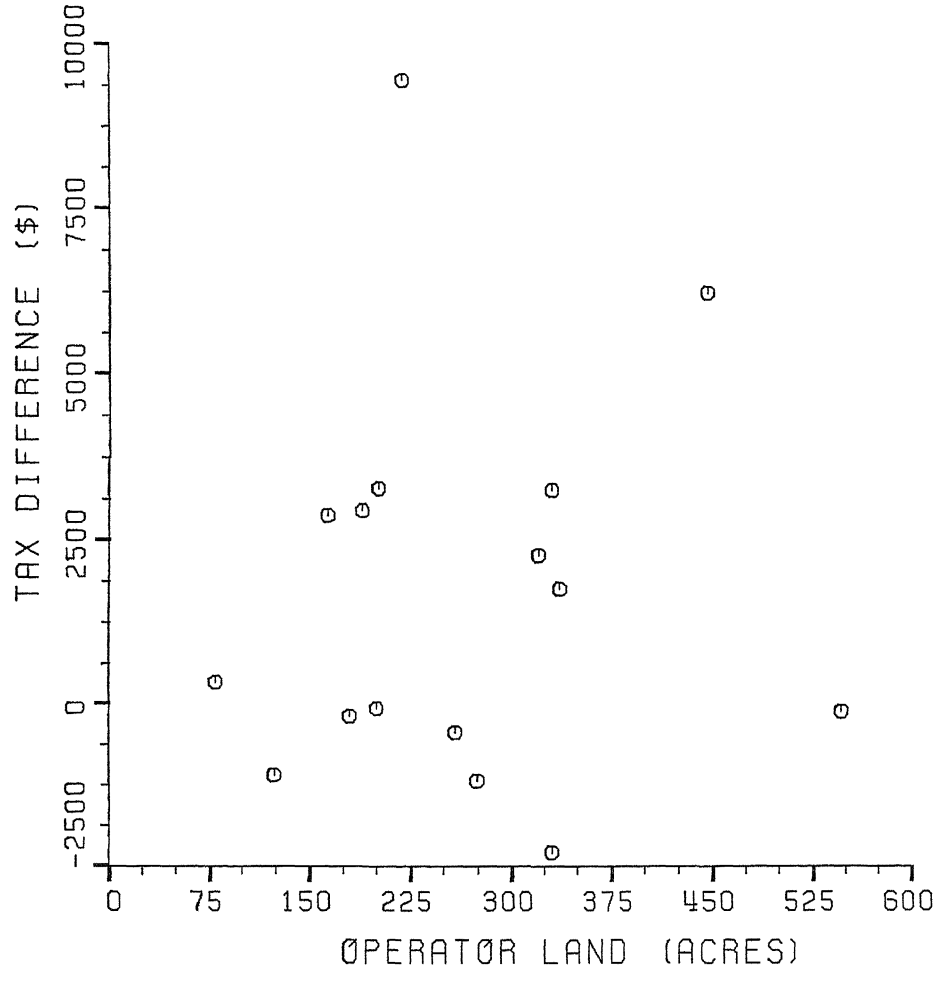
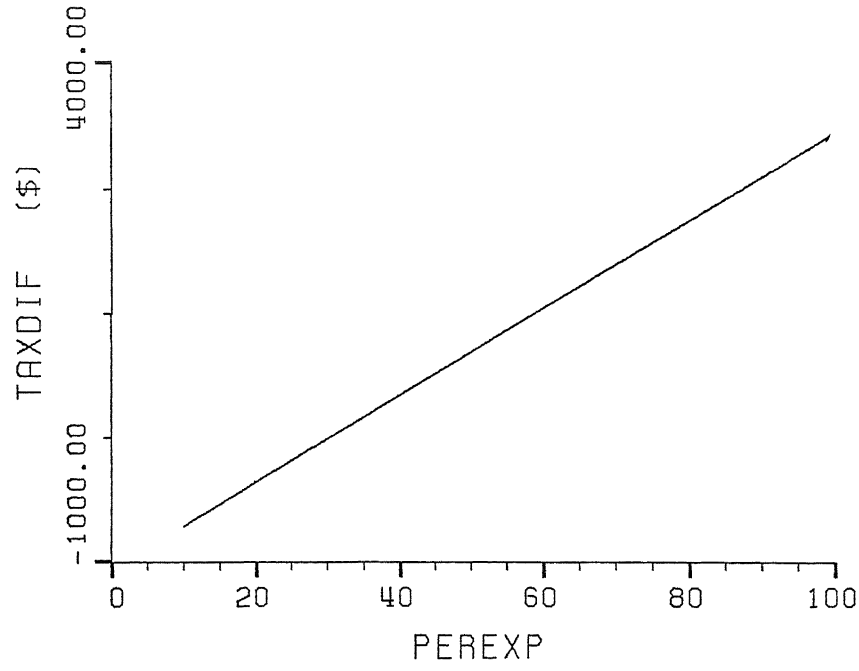


Figure 1. Change in real tax liability resulting from the business expansion.

a.



b.

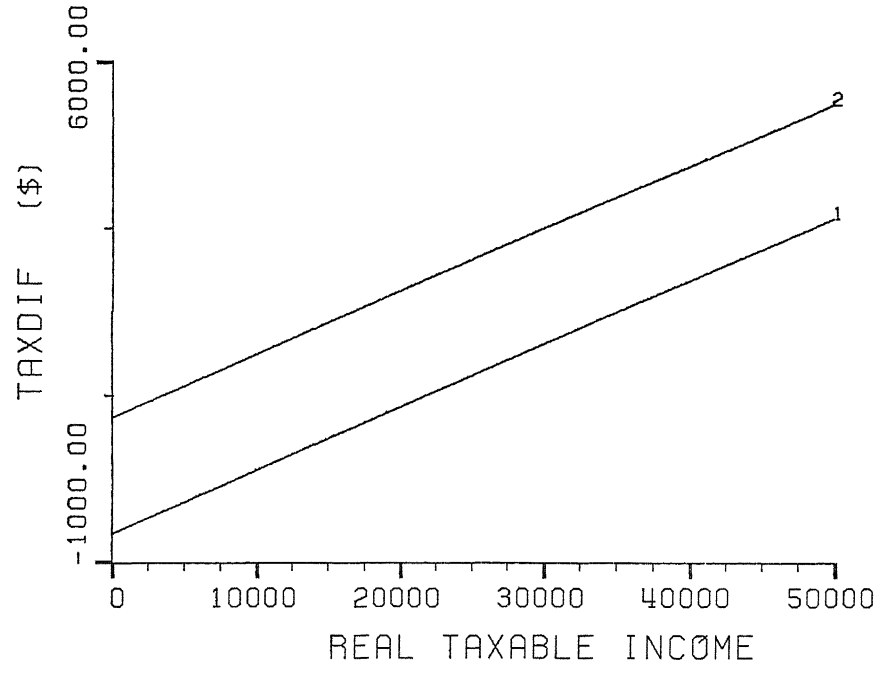


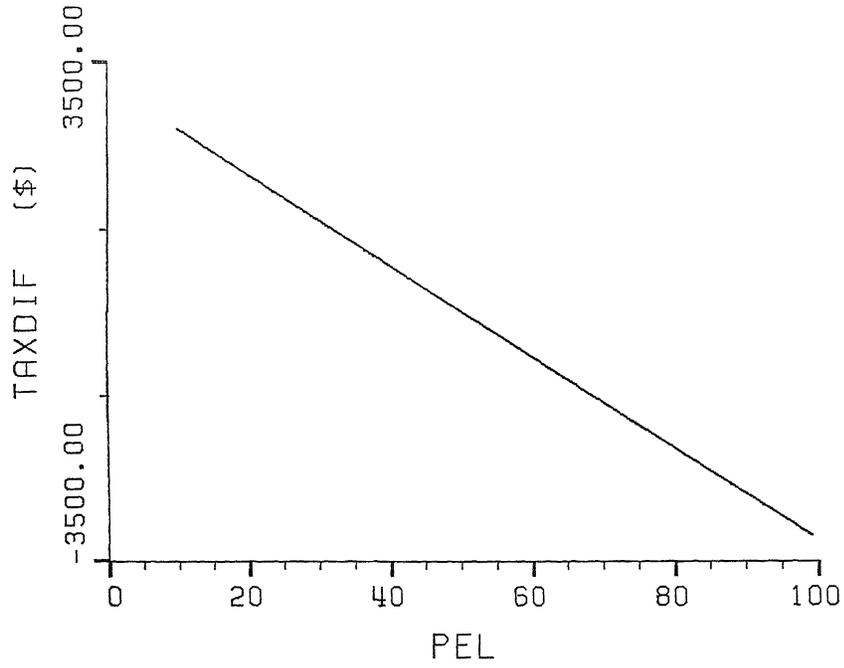
Figure 2. The effects of relative expansion size on the changed tax liability.

a. PEL and RTI are held constant at their sample means.

b. PEREXP as a shifter of TAXDIF = f(RTI)

1. PEREXP = 63.01 (sample mean)
2. PEREXP = 100

a.



b.

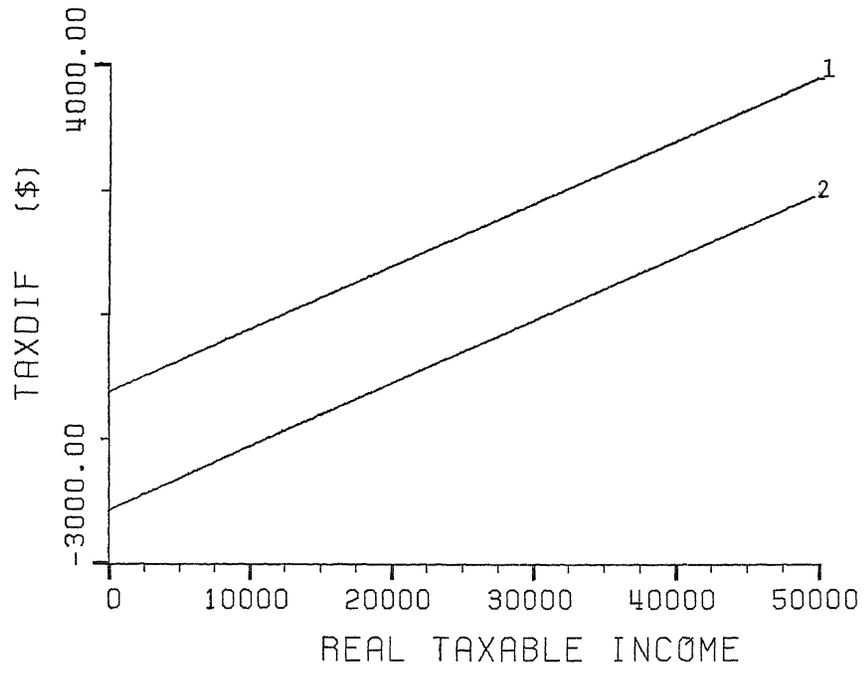


Figure 3. The effects of pre-expansion leverage on the changed tax liability.

a. PEREXP and RTI are held constant at their sample means.

b. PEL as a shifter of TAXDIF = f(RTI)

1. PEL = 24.19 (sample mean)

2. PEL = 50

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